

A Remote Feeder Reactance CoilD E S C R I P T I O N

The invention relates to a remote feeder reactance coil for energy input and output in signal transmission lines as well as in signal transmission systems including signal transmission lines, where intermediate amplifiers are supplied with electrical energy via said signal transmission lines.

Signal transmission systems known from practice transmit a high-frequency signal from a signal source to a signal drain via a signal transmission line, e.g. a coaxial cable. For this purpose, large distances often need to be bridged. As a result, the high-frequency signal will become attenuated even in high-quality lines, for which reason intermediate amplifiers will be required for regenerating the signal level.

In signal transmission systems of the prior art, such intermediate amplifiers may be supplied with electrical energy via the signal transmission line - which will eliminate the need for separate supply lines. In general, signal transmission lines of this design concept are subdivided into plural transmission sections or segments interconnected via couplers which present an as small as possible resistance to the high-frequency wanted signal. Within said transmission sections, energy is input or output via remote feeder reactance coils which constitute separation points for the high-frequency wanted signal. Consequently, the wanted signal will not become substantially attenuated at the input and output sites. However, in view of the specific design of remote feeder reactance coils, there is the danger of resonances occurring at certain frequencies which will limit the useful frequency range of the signal transmission line.

The disadvantages of the remote feeder reactance coils known from practice above all result from the fact that the self-resonances of the circuitry will strongly limit the useful frequency ranges, despite the wirings and different winding types. Furthermore, the inductance values which can be reached with the known remote feeder reactance coils are limited with given volumes. Another problem is the considerable manufacturing effort, especially when such coils are wired with resistors and conductive layers since their exact dimensions and positions will be decisive of the resonance behaviour of the remote feeder reactance coil. The same is true for the variation of the windings, so that, in summary, one can say that prior art remote feeder reactance coils make maximum demands on production engineering, in view of the required precision in manufacturing.

It is the object of the invention to provide a reactionless connection of a high-frequency signal path and a low-frequency energy supply for signal transmission systems over an as broad as possible frequency range, at the same time keeping the required manufacturing effort small.

This object is solved according to the invention by the features of claims 1 to 13.

In accordance with the invention, a remote feeder reactance coil comprises a primary winding, preferably of an electrically insulated conductive material, carrying the feed current, and an attenuation circuit of a kind which has a secondary winding of a preferably electrically insulated conductive material, wherein said secondary and primary windings interact with each other through capacitive and/or inductive coupling. Providing a secondary winding of an electrically insulated conductive material is a much less complex step in manufacturing than the comparable measures of the prior art. At the same time, its presence allows very precise and effective influencing of the self-resonance behaviour of the remote feeder reactance coil since the use of a secondary winding clearly allows more positioning and design alternatives than other means of the prior art.

The use of a secondary winding allows a well-aimed intervention in the internal function mechanism of the reactance coil which results in the secondary winding effectively suppressing undesired interactions of individual winding sections of the primary winding.

Preferably, said primary and secondary windings have substantially parallel winding axes, in particular one common winding axis. This considerably diminishes the required manufacturing effort. If any turns of said secondary winding extend between the turns of the primary winding, the turns of the secondary winding will shield the turns of the primary winding from each other. This will largely eliminate any undesired effects between individual turns of the primary winding which occur in other designs and, cumulated, will cause the disadvantageous resonance effects. If the turns of the primary and secondary windings each are wound the ones on top of the others in a radial direction, a comparatively analogous result is obtained regarding self-resonance suppression.

The possibility of varying the ohmic resistance of said attenuation circuit e.g. by means of an ohmic resistor, allows the attenuation behaviour to be influenced precisely.

The presence of the secondary winding according to the invention allows an increase both of the reproducibility and the precision of remote feeder reactance coils, at the same time leaving a lot of leeway concerning the dimensions, choice of material and wiring of said secondary winding. Another possibility is to electrically connect one end of the secondary winding to the primary winding. Furthermore, if one substitutes complex functioning circuitry for the ohmic resistor, this will allow a well-aimed influencing of the behaviour of the attenuation winding in the frequency range.

Additional advantageous embodiments and further developments of the invention are notable from the subclaims and the description in combination with the drawings, of which:

- Fig. 1 is a schematical view of a transmission section of a signal transmission line of a signal transmission system;
- Fig. 2 a graphical view of the possible influence of a remote feeder reactance coil lacking any self-resonance-supporting measures on the transmission behaviour of a signal transmission system;
- Fig. 3 a view of a first embodiment of a remote feeder reactance coil of the invention, and
- Fig. 4 a view of a second embodiment of a remote feeder reactance coil of the invention.

Sub 617 The transmission section 10 of a signal transmission line shown in Fig. 1 essentially comprises a coaxial cable 14 which has two intermediate amplifiers 16 built into it. Said inter-

mediate amplifiers 16 receive their energy via remote feeder reactance coils 18 of the inventive design which are grounded via a capacitor. The energy output via said remote feeder reactance coils 18 is input to the transmission section 10 (which - concerning energy supply - is separated from the adjacent transmission sections by capacitances 22) via a remote feeder reactance coil 20 for energy input which is likewise of the inventive design and is also grounded via a capacitor.

Fig. 2 shows the possible influence a remote feeder reactance coil lacking any self-resonance-supporting measures may have on the transmission behaviour. It may be gathered from this view that the a.c. resistance will decrease with certain frequencies. This is tantamount to a negative influence on a wanted signal to be transmitted.

Fig. 3 shows a remote feeder reactance coil 100 of a first embodiment of the invention. Said remote feeder reactance coil 100 comprises a primary winding 102 of copper wire which is e.g. wound about a tubular body 104 made of plastic material. Inside said tubular body 104 is a core 106 of ferromagnetic material. The primary winding 102 has its terminal 108 connected to a signal transmission line and its terminal 120 connected to the energy supply.

Extending in parallel to said primary winding 102 is a secondary winding 112 of copper wire whose turns 114, just like the turns 110 of the primary winding 102, extend in close contact with and on said tubular body 104. The turns 114 of the secondary winding 112 extend between the turns 110 of said primary winding 102 and are thus uniformly spaced, likewise viewed from the longitudinal direction of the remote feeder reactance coil. Said secondary winding 114 is closed by an ohmic resistor 116 which is schematically shown, to give an attenuation circuit 118.

Coated on the turns 110 and 114 of the primary and secondary windings 102, 112, resp., i.e. on at least one winding

thereof, is a layer of insulating varnish so as to electrically insulate said turns 110, 114 from each other.

In operation, the terminal 108 of said primary winding 102 is connected to the high-frequency part of a circuit or a signal transmission line. The terminal 120 is both connected to a low-frequency energy input and, via a capacitor for electric shock hazard protection, to circuit ground. In operation, the secondary winding 112, together with the ohmic resistor 116, will generate a resistance load along a section of said primary winding 102, which load will effectively suppress the formation of parasitic resonances in the useful frequency range without considerably influencing the characteristics of said remote feeder reactance coil 100 in high-frequency applications.

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Fig. 4 shows a remote feeder reactance coil 200 of a second embodiment. Since the remote feeder reactance coils 100, 200 of the first and second embodiments are identical in essential design features, design elements of the remote feeder reactance coil 200 of the second embodiment which are identical to those of the remote feeder reactance coil 100 of the first embodiment are marked with basically the same reference numerals as those of the first embodiment, but increased by 100. In this respect, reference is also made to those parts of the description which concern the remote feeder reactance coil 100 of the first embodiment.

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The individual turns 210 of the primary winding 202 of the remote feeder reactance coil 200, which are electrically separated and insulated from each other by means of a varnish coating on the wire material of the primary winding 202, extend in direct and close contact on each other in a first area 222 and a second area 224, while they are spaced from each other in a third area 226 which extends between said first and second areas. Said secondary winding 212 which also includes an ohmic resistor 216 to give an attenuation circuit 218, has turns 214 which, viewed in the radial direction of the remote feeder

reactance coil 200 extend on the external surface of the turns 210 in the first area 222. Said turns 214 contact each other through their varnish coatings. In the remote feeder reactance coil 200 of the second embodiment, the terminal 200 of the primary winding 202 and the terminal of the secondary winding 212 are electrically interconnected.

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